

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images,
please do not report the images to the
Image Problems Mailbox.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : F41G 3/02	A1	(11) International Publication Number: WO 92/14982 (43) International Publication Date: 3 September 1992 (03.09.92)
--	----	--

(21) International Application Number: PCT/SE91/00105

(22) International Filing Date: 14 February 1991 (14.02.91)

(71)(72) Applicants and Inventors: PÅLSGÅRD, Göte [SE/SE];
Nygatan 28, S-702 11 Örebro (SE). ÖSTLIN, Lars-Olov
[SE/SE]; Gundbo 3328, S-822 00 Alfta (SE).

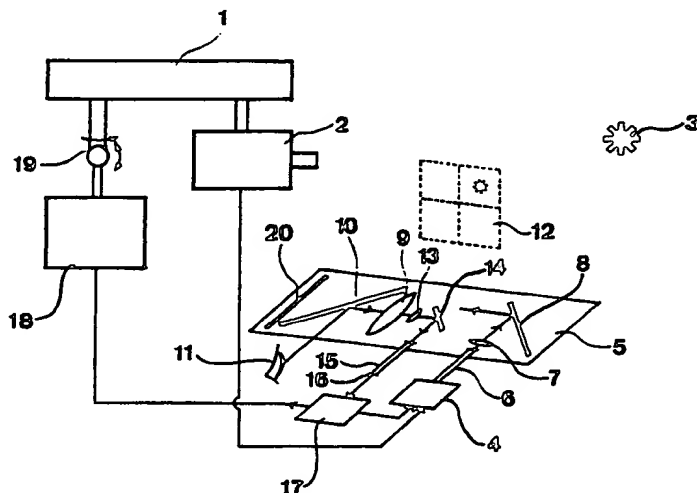
(74) Agent: BJERKÉN, Jarl, Håkan; Bjerkéns/Gävle Patentbyrå AB, Box 304, S-801 04 Gävle (SE).

(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.

Published

*With international search report.**In English translation (filed in Swedish).*

(54) Title: ALIGNMENT DEVICE



(57) Abstract

A device for alignment controlled by the gaze direction of a person of an object (1) with respect to a thing (3) comprises means (9, 10, 13-16) for determining the gaze direction of a person, an evaluating unit (17) adapted to treat information received from said means about the gaze direction of the person and emit control signals, and a unit (18) for receiving the control signals from the evaluating unit so as to by an adjusting member (19) adjust the direction of the object in dependence on the gaze direction of the person. This device comprises furthermore a camera (2) adapted to by means of a displaying arrangement (4, 6-10) show a picture including said thing (3) to the person. The camera (2) is fixed to or constitutes the object. The evaluating unit (17) is adapted to send control signals to the direction adjusting unit (18) adapted to cause the latter to adjust the object and by that the camera so that the gaze of the person strikes said thing in a certain position on said picture.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FI	Finland	MI	Mali
AU	Australia	FR	France	MN	Mongolia
BB	Barbados	GA	Gabon	MR	Mauritania
BE	Belgium	GB	United Kingdom	MW	Malawi
BF	Burkina Faso	GN	Guinea	NL	Netherlands
BG	Bulgaria	GR	Greece	NO	Norway
BJ	Benin	HU	Hungary	PL	Poland
BR	Brazil	IE	Ireland	RO	Romania
CA	Canada	IT	Italy	RU	Russian Federation
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark	MG	Madagascar		
ES	Spain				

Alignment device

FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a device for alignment controlled by the gaze direction of a person of an object with respect a thing, which comprises means for determining the gaze direction of a person, an evaluating unit adapted to treat information received from said means about the gaze direction of the person and emit control signals, and a unit for receiving the control signals from the evaluating unit so as to by an adjusting member adjust the direction of the object in dependence on the gaze direction of the person.

Such a device is already known by for example US patent publication 3 462 604 which describes a device for adjusting the direction of a weapon or a machine in dependence on the gaze direction of a person. The person is in this device looking directly on the thing towards which the weapon shall be adjusted and a picture sensor senses the picture of the eye of the person so as to determine in which direction the person looks and on the basis thereof control the weapon. A disadvantage of this device is that said thing towards which a person intends to direct a weapon may be located in the periphery of the field of

- 2 -

sight of the person and watching that thing may be uncomfortable. Another disadvantage is that the person may not himself by simple means control that the weapon is really directed in the direction he is looking in.

BRIEF DESCRIPTION OF THE INVENTION

The object of the present invention is to provide a device of the kind mentioned in the introduction, which is freed from the disadvantages of the device discussed above.

This object is according to the invention obtained by providing a device of said kind with a camera arranged to by means of a displaying arrangement show a picture including said thing to the person, that said means are adapted to determine the direction of the gaze of said person, when this is directed towards said thing on this picture, that the camera is fixed to or constitutes the object, and that the evaluating unit is adapted to send control signals to the direction adjusting unit adapted to cause the latter to adjust the object and by that the camera so that the gaze of the person strikes said thing in a certain position on said picture.

Thanks to the fact that a camera is adapted to by means of a displaying arrangement show a picture including said thing to the person and the camera is fixed to or constitutes the object to be aligned with respect to said thing, the person may look at said thing in a desired part of the field of sight corresponding to comfortable looking, and the person may easily check that the object has a certain alignment with respect to said thing, since the position of said thing on the picture viewed at directly corresponds to the alignment of the object with respect to said thing.

- 3 -

An advantage characteristic of the invention is defined in subclaim 3, namely that the evaluating unit is arranged to in dependence on the gaze direction of a person influence the direction adjusting unit to adjust the object and by that the camera so that the thing viewed at by the person arrives in the middle of the camera picture. This makes it very comfortable for the person to achieve the alignment adjustment of the object aimed at.

The present invention also concerns a device for distance measuring, which has as object to simplify the measuring of a distance to a thing with respect to prior art devices for this purpose.

This object is according to the invention obtained by a device comprising two cameras located at a mutual distance along a base line and so as to be directed with their camera axes substantially in the same plane, and a picture filter unit adapted to receive picture signals from the respective cameras and filter them, so as to send picture lines with certain serial numbers coming from one camera and picture lines with the rest of the serial numbers coming from the other camera to a displaying arrangement also being a part of the device, that the displaying arrangement is arranged to show a picture created by the picture lines sent from the picture filter unit, that at least one of the cameras is pivotally arranged, that the direction of the camera axes relative to each other is arranged to be adjusted so that a thing to which a distance is to be measured occurs continuously in the middle of a picture shown by the displaying arrangement, and that means are arranged to after this adjustment measure the angle of each of the camera axes relative to the base line so as to permit to calculate the distance between the thing and a chosen point along said base line by means of information

- 4 -

about these two angles and the distance between the cameras along the base line.

Thanks to the characteristic of the picture filter unit to send on only certain picture lines from the respective camera to the displaying arrangement, it is possible to create one single picture from the two camera pictures and in a very exactly way direct the two cameras towards the thing in question. When a continuous picture of said thing has been obtained in the middle of the picture of the displaying arrangement, the distance between said thing and a point on said base line, for example one of the cameras, may be calculated by putting the two angles and a distance between the cameras into trigonometric formulas.

In order to further increase the accuracy of the distance measuring device according to the invention the cameras may be provided with a zoom function, so that first of all a coarse adjustment may be made with a comparatively large picture angle and after that a fine adjustment may be carried out with a smaller picture angle, i. e. with the thing magnified on the picture of the displaying arrangement.

Further advantages and preferred characteristics of the inventions will appear from the following description and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a description of preferred embodiments of the inventions cited as examples. In the drawings:

- 5 -

Fig. 1 is a simplified block diagram illustrating the function of an embodiment of the alignment device according to the invention,

Fig. 2 is a perspective view illustrating a second embodiment of the alignment device according to the invention,

Fig. 3 is a simplified block diagram illustrating a first embodiment of the distance measuring device according to the invention, and

Fig. 4 is a schematic view illustrating a particular application of the distance measuring device according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The principal of function of a preferred embodiment of the alignment device according to the invention is illustrated in a simplified way in Fig. 1. The device is adapted to align an object 1 with respect to a thing 3 viewed at through a camera 2. The camera 2 is fixed to the object 1 and accordingly movable together therewith. The camera 2 is arranged to send picture signals to a displaying arrangement, which comprises a camera picture producing unit 4, a cable 6 with optical fibres carrying a picture from the unit 4 to a carrier 5, the end of said cable being arranged with the cross section surface in a fixed position on the carrier and so directed that light from the cable 6 strikes a first lens arranged on the carrier 5, which is adapted to carry the light from the unit 4 on to a first plane mirror 8, which is so arranged that it reflects the light last mentioned towards a second lens 9. The light from the unit 4 will strike a second plane mirror 10 and behind this

- 6 -

plane mirror produce a virtual picture 12 perceptable to an eye 11 of a person, said picture corresponding to the picture produced by the camera 2 through the camera picture producing unit 4.

The carrier 5 is intended to be arranged in a fixed position with respect to and in front of an eye of a person. The carrier may be constituted by conventional glasses, spectacle frames being specially designed and the like.

The device comprises also means for determining the gaze direction of the eye 11 of the person. These means comprise a second plane mirror 10, which is so arranged that the light emitted by the eye 11 of the person strikes said mirror and is reflected towards the second lens 9, which is arranged to bring said light together, so that it strikes a third lens 13 being considerably smaller, which is arranged to influence the light emitted by the eye to strike upon a comparatively small third plane mirror 14 located therebehind, which is so directed that it guides said light towards a cross section surface of a second cable 15 with optical fibres. Thus, the light striking said cross section surface corresponds to a picture of the eye 11. Light information arriving to the cable 15 is passed on by this and transmitted to a light sensitive element 16, for example a photo-diod. The piece of light information are here converted to a picture corresponding to the direction of the eye, which is made possible by the fact that different parts of the eye emit light of different intensity, e.g. the light intensity emitted from the pupil surface unit is considerably lower than the one emitted from the white part of the eye. Information about the direction of the eye is sent on from the light sensitive element 16 to an evaluating unit 17 schematically indicated, which is adapted to treat said information and send control signals

- 7 -

to a unit 18 for adjusting the direction of the object 1 through an adjusting member 19. A black plate 20 is attached to the carrier 5 in a suitable position with respect to the optical system, which consists of the parts 9, 10, 13-15, in order to avoid that environmental light is falling onto the third plane mirror 14 and reflected by the cable 15, with incorrect information about the position of the eye 11 as a consequence.

The picture 12 shown to the eye 11 of the person is divided by the evaluating unit 17 into an imagined system of Cartesian coordinates with the origin of coordinates in the middle of the picture. It is the intention that the person with his eye 11 shall view at the thing 3 shown on the virtual picture 12. The evaluating unit is adapted to, from the piece of picture information coming from the light sensitive element 16, derive a signal corresponding to the X-coordinate of the striking point of the gaze on the picture shown and a signal corresponding to the Y-coordinate thereof and convert these coordinate signals to signals for adjusting the direction of the object 1, so that said thing 3 is moved to the origin of coordinates of the imagined system of coordinates. Thus, an alignment of the camera 2 towards said thing 3 takes place and thanks to the fixation of the camera to the object 1 also of the latter with respect to said thing 3. The object 1 may be directed parallelly to the camera 2, so that also the object 1 with one extremity thereof points towards said thing 3, but it would also be conceivable that a different relative alignment of the object 1 and the thing 3 takes place.

The evaluating unit may be adapted to send control signals to the direction adjusting unit 18 not until it during a predetermined period of time has received substantially unchanged information about the gaze direction of the

- 8 -

person from the light sensitive element 16. This delay may be advantageous so as to avoid disturbances of the direction adjustment of the object 1 induced by short twinklings or side glances of the eye of the person.

A preferred embodiment of the device according to the invention is shown in Fig. 2. The object to be aligned or directed and the camera are in this embodiment combined in a TV-camera 1. The carrier 5 is arranged on a spectral frame in front of one eye of the person and has the components with the reference numerals 4-10 and 13-17 shown in Fig. 1. The evaluating unit arranged on the carrier is adapted to send control signals to the direction adjusting unit 18, which in its turn is adapted to cause adjusting of the direction of the TV-camera 1. The person in question may accordingly look at a desired thing on the picture shown by the TV-camera 1 through the displaying arrangement and by his gaze control the TV-camera to be aligned with said thing, i.e. bring it into the middle of the picture. This may be a very comfortable way to control a TV-camera.

It would of course also be possible to control quite different objects by means of the device according to the invention, and microscopes, astronomical instruments and different types of weapons are some examples of such possible objects.

It would of course also be possible to in the alignment device according to the invention replace the means shown in Fig. 1 for determining the gaze direction of the eye of a person by any other means with the same ability, for instance a camera directed towards the eye of the person. However, it is very advantageous to use a carrier fixed with respect to the eye of the person of the type shown in Figs. 1 and 2, since otherwise problems arise concerning

- 9 -

the position of the eye of the person with respect to the means for determining the gaze direction.

The schematical construction and the way to operate of a distance measuring device according to the present invention is illustrated by means of Fig. 3.

The device comprises two cameras 1, 2, which are pivotally arranged about one optical centre each, said optical centres being located at a fixed mutual distance along a base line. The cameras may be pivotally arranged also in the vertical direction besides in the horizontal direction, but it is the intention that the camera axis of one of the cameras is continuously directed in the same plane as the camera axis of the other camera. The cameras 1, 2 are adapted to send picture signals to a picture filter unit 3 schematically indicated, which is arranged to filter these signals so as to only send picture lines having odd serial numbers and coming from one of the cameras and picture lines having even serial numbers and coming from the other camera to a displaying arrangement. The displaying arrangement is adapted to show a picture created by the picture lines sent by the picture filter unit, as in the case in Fig. 3, since the two cameras 1 and 2 are directed towards the stick A, in which also B is a stick, looks like the picture indicated in the Figures at the reference numeral 4. When the two cameras are directed towards one and the same thing, here the stick A, this thing may accordingly occur continuously in the middle of the picture. The reference numeral 4 represents here the displaying arrangement as well as the picture shown thereby. Pieces of information about the appearance of the picture are led or are by hand entered into an evaluating unit 5, which is arranged to treat these pieces of information and send control signals elaborated on the basis thereof to

- 10 -

adjusting members not shown for adjusting the direction of the cameras. The perfect direction adjustment of the cameras has already been obtained in Fig. 3, if it is desirable to direct them towards the stick A in order to measure a distance thereto. However, should the distance to the stick B be measured, the evaluating unit 5 would send control signals to said adjusting members for pivoting the camera 1 to the left and the camera 2 to the right until the strokes B' on the picture 4 form a continuous picture of the stick B in the middle of the picture. When the evaluating unit or the operator is satisfied with the appearance of the picture 4, a unit 7 for calculating the distance between the thing in question (in Fig. 3 the stick A) and any point along the base line between the cameras is activated through a starting unit 6. Each camera is connected to an angle measuring member for measuring the angle made by the camera axis of the respective camera with said base line and continuously sending information thereabout to the calculating unit 7. These angles are in Fig. 3 indicated by α and β .

Trigonometrical formulas well known are adapted for the calculation of the distance mentioned above. Assume that for example the distance C between the stick A and the optical centre of the camera 1 shall be calculated. The calculating unit 7 is then using the following formula.

$$S = \frac{l \sin \alpha}{\sin \gamma}$$

in which l is the distance between the two optical centres and $\gamma = 180^\circ - \alpha - \beta$.

The cameras 1, 2 may advantageously be provided with a zoom function, so that first of all a coarse adjustment may be

- 11 -

done with a comparatively large picture angle of the cameras and the evaluating unit sends signals to the cameras after obtaining a continuous picture of the thing in question in the middle of the picture so as to reduce the picture angle, i.e. magnifying said thing, for fine adjustment of the camera angles before the calculating unit 7 is activated. This further increases the reliability of the distance measuring device already delivering very accurate results.

A special application of the distance measuring device according to the invention is schematically illustrated in Fig. 4. One of the cameras 1 is fixed on a gun-carriage 8 of a gun. The gun-carriage is rotatable about a vertical axis, but preferably also about a horizontal axis, so as to adjust the direction of the camera 1. The camera 2 is rotatably arranged about an optical centre in at least the horizontal direction, but preferably also in the vertical direction. The relative distance between the centres of rotation of the two cameras is preferably fixed, but it could also be varied in the case there are means for determining the distance existing therebetween in each moment. Picture signals are led from the two cameras to a picture filter unit 9. This unit is adapted to filter the picture signals and send signals corresponding to requested picture lines from a respective camera on to a displaying arrangement. This displaying arrangement is of the type described in Fig. 1 and arranged on a carrier 10 located in front of an eye of a person. Means for determining the gaze direction of the person of the kind shown in Fig. 1 are also arranged on the carrier 10. Thus these means include an optical system with mirror and lenses. Accordingly, a virtual picture is shown to the person, said picture being created by the views of the cameras 1 and 2. The person directs his gaze towards a presumptive target on said

- 12 -

picture and after determining the gaze direction of the person information thereabout is sent to an evaluating unit 11, which is arranged to, from these pieces of information, elaborate control signals and send them to direction adjusting units 12 of the gun-carriage 8 and the second camera 2, respectively, (not shown).

The picture filter unit 9 may be adapted to, during a first period of time, attend to that the displaying arrangement only show the picture from a first camera to the person and a direction adjustment of this camera towards said thing takes place through information about the gaze direction of the person and the evaluating unit, whereupon, during a second period of time, the picture filter unit 9 only sends pictures from the second camera to the displaying arrangement, whereupon a direction adjustment of the second camera takes place through the gaze direction of the person and the evaluating unit. The picture filter unit could after that send picture lines coming from one of the cameras and having odd serial numbers and picture lines coming from the other camera and having even serial numbers to the displaying arrangement, so as to display the continuous thing in the middle point of the picture. In the case that the thing is movable, it is important that means are arranged to, after adjustment of said thing in the middle of the picture, make the direction adjusting units and by that the direction of the cameras to slaves of the position of the target so as to keep the target picture in the middle of the picture shown independent of the movement of the target. The picture filter unit does in this case send information on directly to the evaluating unit, which elaborates and sends control signals to the direction adjusting units for continuously correcting deviations from the picture centre of the respective camera of said thing occurring. This slavery may be started automatically or by

- 13 -

the person, when he is satisfied with the direction adjustment of the two cameras.

By the fixed arrangement of the first camera 1 on the gun-carriage 8 of the canon the gun-carriage 8 will on directing the camera 1 towards said thing automatically also be directed thereagainst. Angle measuring members are arranged on each camera to send information about the angle between the camera axis of the camera in question and the base line connecting the centres of rotation of the two cameras to a calculating unit 13. The calculating unit 13 functions in the way described in connection with the calculating unit 7 in Fig. 3. Thus, the calculating unit 13 may calculate a distance between the camera 1, i.e. the gun-carriage 8 and the thing 14, in this case an aeroplane. The calculating unit 13 is adapted to send this piece of distance information to a unit 15 for controlling the elevation adjustment of the tube 16 of the canon in dependence thereon. The angle measuring unit and a computer unit may also be incorporated into the unit 15. The calculating unit 13 may also be adapted to, from information about the movement of the camera 1 and the distance change between the camera 1 and said thing 14, calculate the velocity of said thing and send these signals to the unit 15, so that a direction adjustment of the tube 16 may take place while taking the movability of the target into consideration. The tube may also be laterally movable, so that an aiming ahead may be achieved on lateral movement of the target.

Of course no unit for making slaves will be needed should the target be fixed, but the person may look at the camera pictures for direction adjustment of one camera at the time, so that a continuous picture of said thing is created in the middle of the virtual picture. It would then also be

- 14 -

possible to omit the gaze direction control and instead arrange a control of the kind shown in Fig. 3.

The invention is of course not limited to the distance measuring devices described above, but several modification possibilities thereof would be apparent to a man skilled in the art without diverting from the basic idea of the invention.

The displaying arrangement in the device according to Fig. 3 could for instance be arranged to show the picture of said thing on a viewing screen with a cursor controllable by a so called joy-stick, wherein the actuation of said joy-stick then would be intended to generate and send control signals to the adjustment members for adjusting the relative direction of the camera axis.

The fields of use could be very different, but as some possible ones distance determinations in the country, for instance for military or land-surveying purposes, and navigation on the sea, especially in harbour light-houses, may be mentioned.

The picture filter unit could of course be arranged to select picture lines coming from a camera and having arbitrary serial numbers and picture lines coming from the other camera and having the rest of the serial numbers for the displaying arrangement.

The word the rest here means the picture lines lying between the picture lines selected from the first camera in the region of the picture in which the thing in question is located, so that said thing may be reproduced continuously on the picture. Thus, it is also within the scope of the invention to remove picture lines with certain serial

- 15 -

numbers from both camera pictures, in the case that these lines lie clearly outside the picture region of interest for the directing of the cameras. This should be considered when interpreting the expression "the rest of the serial numbers" in the appended independent claim.

In the embodiment shown in Fig. 3, it would also be possible to omit the calculating unit and the distance calculation after reading the camera axis angles could take place "by hand" for instance by using a pocket calculator.

- 16 -

Claims

1. A device for alignment controlled by the gaze direction of a person of an object with respect to a thing, which comprises means (9, 10, 13-16) for determining the gaze direction of a person, an evaluating unit (17) adapted to treat information received from said means about the gaze direction of the person and emit control signals, and a unit (18) for receiving the control signals from the evaluating unit (17) so as to by an adjusting member (19) adjust the direction of the object (1) in dependence on the gaze direction of the person,

c h a r a c t e r i z e d in that it furthermore comprises a camera (2) adapted to by means of a displaying arrangement (4, 6-10) show a picture (12) including said thing (3) to the person, that said means are adapted to determine the direction of the gaze of said person, when this is directed towards said thing on this picture, that the camera (2) is fixed to or constitutes the object, and that the evaluating unit (17) is adapted to send control signals to the direction adjusting unit (18) adapted to cause the latter to adjust the object (1) and by that the camera (2) so that the gaze of the person strikes said thing in a certain position on said picture.

2. A device according to claim 1,

c h a r a c t e r i z e d in that said means are adapted to deliver a signal corresponding to the x-coordinate of the strike point of the gaze on the picture shown and a signal corresponding to the y-coordinate of the same of a system of Cartesian coordinates drawn up with the centre of the picture as origin of coordinates to the evaluating unit (17), and that the evaluating unit is arranged to transform these coordinate signals to signals for adjusting the

- 17 -

direction of the object (1) so that the object is moved to a desired point in the system of coordinates of the picture.

3. A device according to claim 2, characterized in that the evaluating unit (17) is adapted to, in dependence on the deviation of the picture point with respect to the origin of coordinates, send control signals to the direction adjusting unit (18) for adjusting the object (1) so that the gaze of the person strikes said thing in the origin of coordinates of the system of coordinates of the picture and by that the camera (2) and the object (1) are directed towards said thing (3).

4. A device according to any of the claims 1-3, characterized in that the displaying arrangement (4, 6-10) is adapted to show the camera picture in a position fixed with respect to the head of the person, and that said means comprise members (9, 10, 13-15) arranged in a fixed position with respect to the head of the person for absorbing a picture of an eye (11) of the person.

5. A device according to claim 4, characterized in that said members comprise an optical system arranged closely in front of one of the eyes (11) of said person, comprising mirrors (10, 14) and/or lenses (9, 13) and arranged to throw a picture of the eye of the person directly upon a light sensitive element (16), or the optical system comprises also or only a light receiving and transmitting conduit (15) arranged closest to the light sensitive element (16) in the path of the light from the eye.

6. A device according to any of the preceding claims,

- 18 -

c h a r a c t e r i z e d in that said object (1) is a TV-camera adapted to be controlled by that the person is looking at the thing he wishes to film.

7. A device according to any of the preceding claims, c h a r a c t e r i z e d in that the evaluating unit (17) is adapted to send control signals to the direction adjusting unit (18) not until it during a predetermined period of time has received unchanged information about the gaze direction of the person from said means.

8. A device for measuring distances, c h a r a c t e r i z e d in that it comprises two cameras (1, 2) located at a mutual distance along a base line and so as to be directed with their camera axes substantially in the same plane, and a picture filter unit (3) adapted to receive picture signals from the respective cameras and filter them, so as to send picture lines with certain serial numbers coming from one camera and picture lines with the rest of the serial numbers coming from the other camera to a displaying arrangement (4) also being a part of the device, that the displaying arrangement is arranged to show a picture created by the picture lines sent from the picture filter unit, that at least one of the cameras is pivotally arranged, that the direction of the camera axes relative to each other is arranged to be adjusted so that a thing (A) to which the distance is to be measured occurs continuously in the middle of the picture shown by the displaying arrangement, and that means are arranged to after this adjustment measure the angle of each of the camera axes relative to the base line so as to permit to calculate the distance between the thing (A) and a chosen point along said base line by means of information about these two angles and the distance between the cameras along the base line.

- 19 -

9. A device according to claim 8, characterized in that said picture filter unit (3) is arranged to send picture lines having odd serial numbers coming from one camera and picture lines having even serial numbers coming from the other camera to said displaying unit (4).

10. A device according to claim 8 or 9, characterized in that said cameras are pivotally arranged about an optical centre each, and that the device comprises a control unit for controlling adjusting members of the cameras and by that adjusting the direction thereof in dependence on the appearance of the picture of said thing of the displaying arrangement.

11. A device according to claim 10, characterized in that the displaying arrangement is adapted to display the picture of said thing on a viewing screen with a cursor controlled by means of a so called joy stick, and that actuating of said joy stick is adapted to generate and send control signals to said adjusting members for adjusting the direction of the camera axes relative to each other.

12. A device according to any of the claims 8-11, characterized in that said angle measuring means are connected to a calculating unit (7) adapted to calculate the distance requested after receiving said angle information.

13. A device according to any of the claims 8-10 and 12, characterized in that the displaying arrangement is arranged to show said picture to a person, that the device comprises means for determining the gaze direction

of the person, when this is directed on portions of said thing on this picture, and an evaluating unit (11) adapted to receive and treat information about the gaze direction of the person from said gaze direction means and send control signals elaborated on the basis of information about the gaze direction of the person to a unit (12) adapted to adjust the direction of the cameras (1, 2) by adjusting members so that the person sees a continuous picture of said thing in the middle of said picture.

14. A device according to claim 13,
c h a r a c t e r i z e d in that it comprises means for controlling the picture filter unit to during a first period of time only send picture lines with said serial numbers coming from a first of the cameras to the displaying arrangement, said person being expected to direct his gaze towards these portions of said thing on the picture shown during said first period, that the evaluating unit (5, 11) is adapted to control the direction adjusting unit in dependence on the gaze direction of the person so as to adjust the direction of this first camera so that said portions of said thing arrive to the middle region of said picture, that said control means are arranged to during a second period of time following the first one control the picture filter unit to also send picture lines having said serial numbers coming from the second camera to the displaying arrangement, said person being expected to direct his gaze towards the portions of said thing remote with respect to the middle region of the picture, and that the evaluating unit (5, 11) is arranged to during said second period of time control the direction adjusting unit in dependence on the gaze direction of the person to adjust the direction of the second camera so that said thing appears continuously in the middle of the picture shown by the displaying arrangement.

- 21 -

15. A device according to claim 13 or 14,
c h a r a c t e r i z e d in that a first (1) of the
cameras is secured to an object (8) to be aligned with
respect to said thing (14), so that said object (8) and the
first camera (1) are arranged to be jointly aligned by
means of the gaze direction of the person.

16. A device according to claim 15,
c h a r a c t e r i z e d in that the object (8) comprises
a rotatable part of a weapon, said thing being a target,
that said calculating unit (13) is arranged to send infor-
mation calculated about the distance between the first
camera (1) and the target (14) to a firing unit (15) for
adjusting the tube (16) of the weapon in dependence on the
distance to the target and the position thereof with
respect to the weapon.

17. A device according to claim 16,
c h a r a c t e r i z e d in that the evaluating unit (11)
is arranged to, after obtaining a continuous picture of the
target in the middle of the picture shown to the person,
make the alignment of the direction adjusting unit (12) and
by that the cameras to slaves of the position of the target
so as to keep the picture of the target in the middle of
the picture shown independently of the movement of the
target, that means are arranged to detect the velocity of
the first camera on the direction adjustment thereof and
send information thereabout to the calculating unit (13),
which is also arranged to calculate the velocity of the
target, and that the firing unit (15) is arranged to
receive information also about the velocity of the target
for adjusting the tube (16) of the weapon while taking also
the velocity of the target under consideration when the
target (14) is moving.

- 22 -

18. A device according to any of the claims 13-17, characterized in that the displaying arrangement is arranged to show the camera picture in a position fixed with respect to the head of the person, and that said means for determining the gaze direction of the person comprise members arranged in a fixed position with respect to the head of the person for absorbing a picture of an eye of the person.

19. A device according to claim 18, characterized in that said members comprise an optical system arranged closely in front of one of the eyes of said person and comprising mirrors and/or lenses arranged to throw a picture of the eye of the person directly upon a light sensitive element, or the optical system also or only comprises a light receiving and transmitting conduit arranged closest to the light sensitive element in the path of the light from the eye.

20. A device according to any of the claims 8-19, characterized in that the cameras (1, 2) have a zoom-function, and that the evaluating unit (5, 11) is arranged to, after receiving information about the obtention of a continuous picture of said thing in the middle of the picture shown, control the cameras to reduce the picture angle, i. e. magnify said thing on the picture for fine adjustment of the camera angles before said distance calculation takes place.

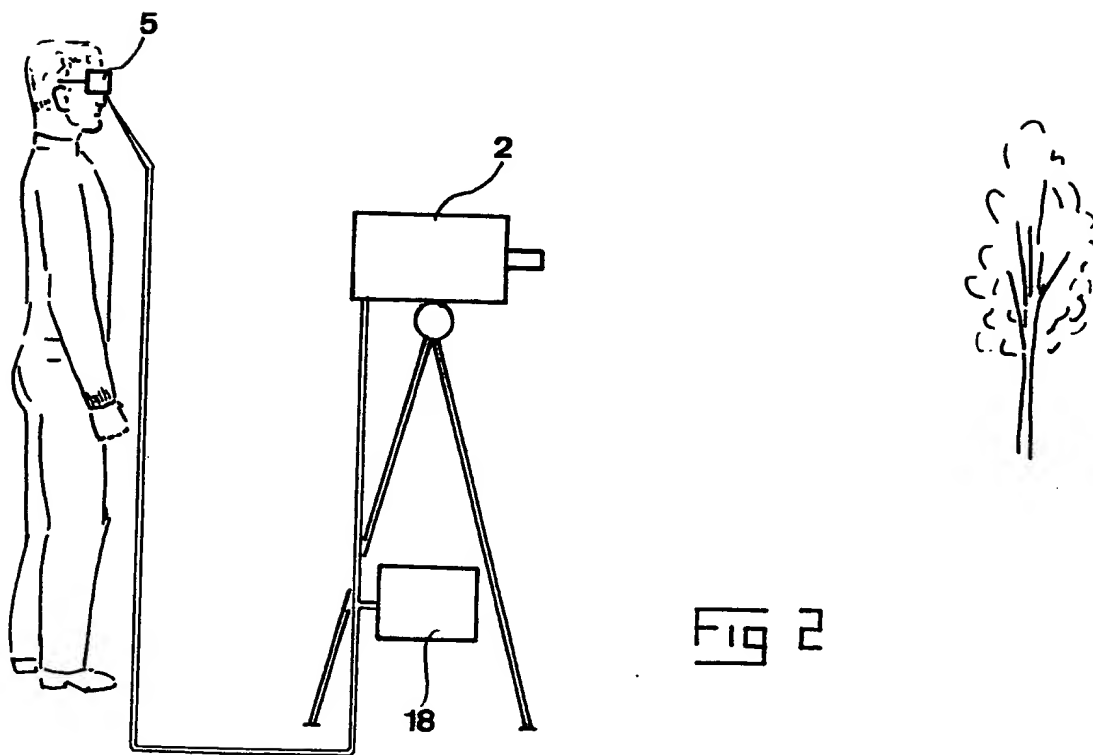
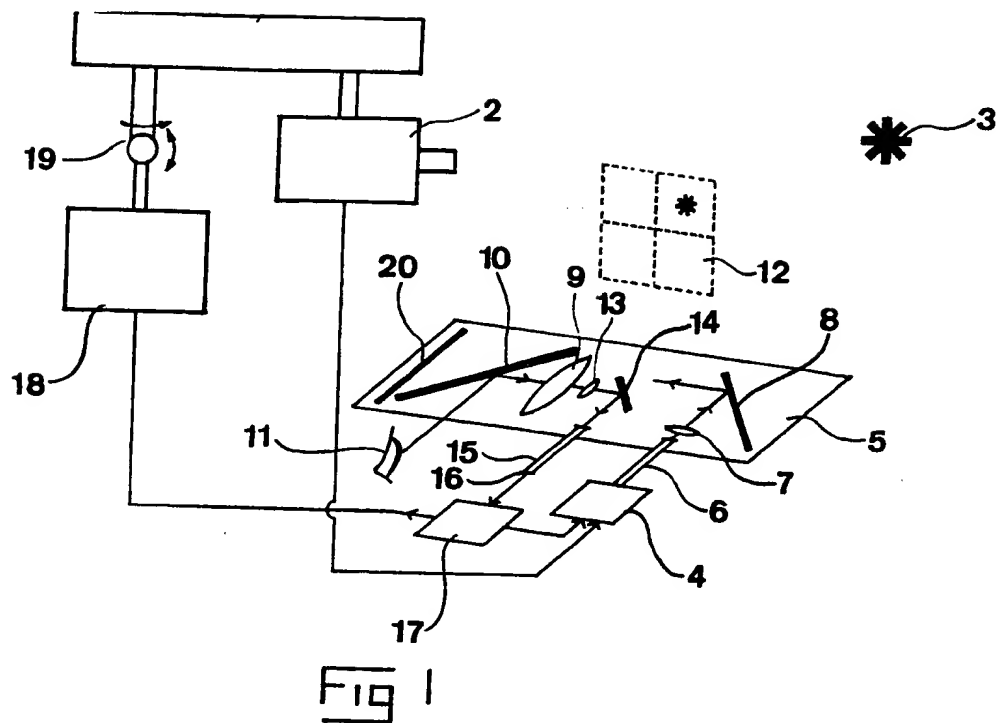
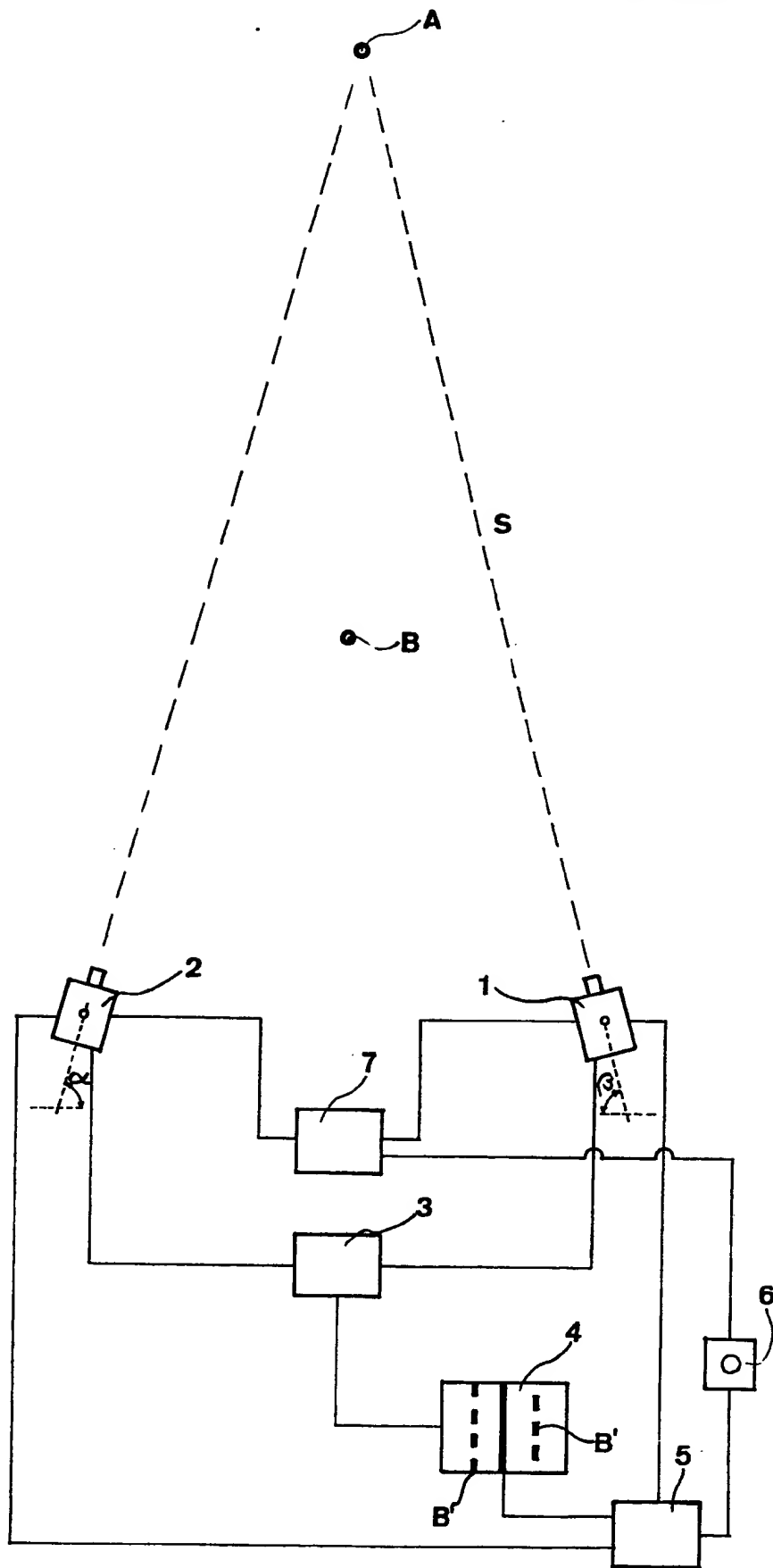


FIG 3



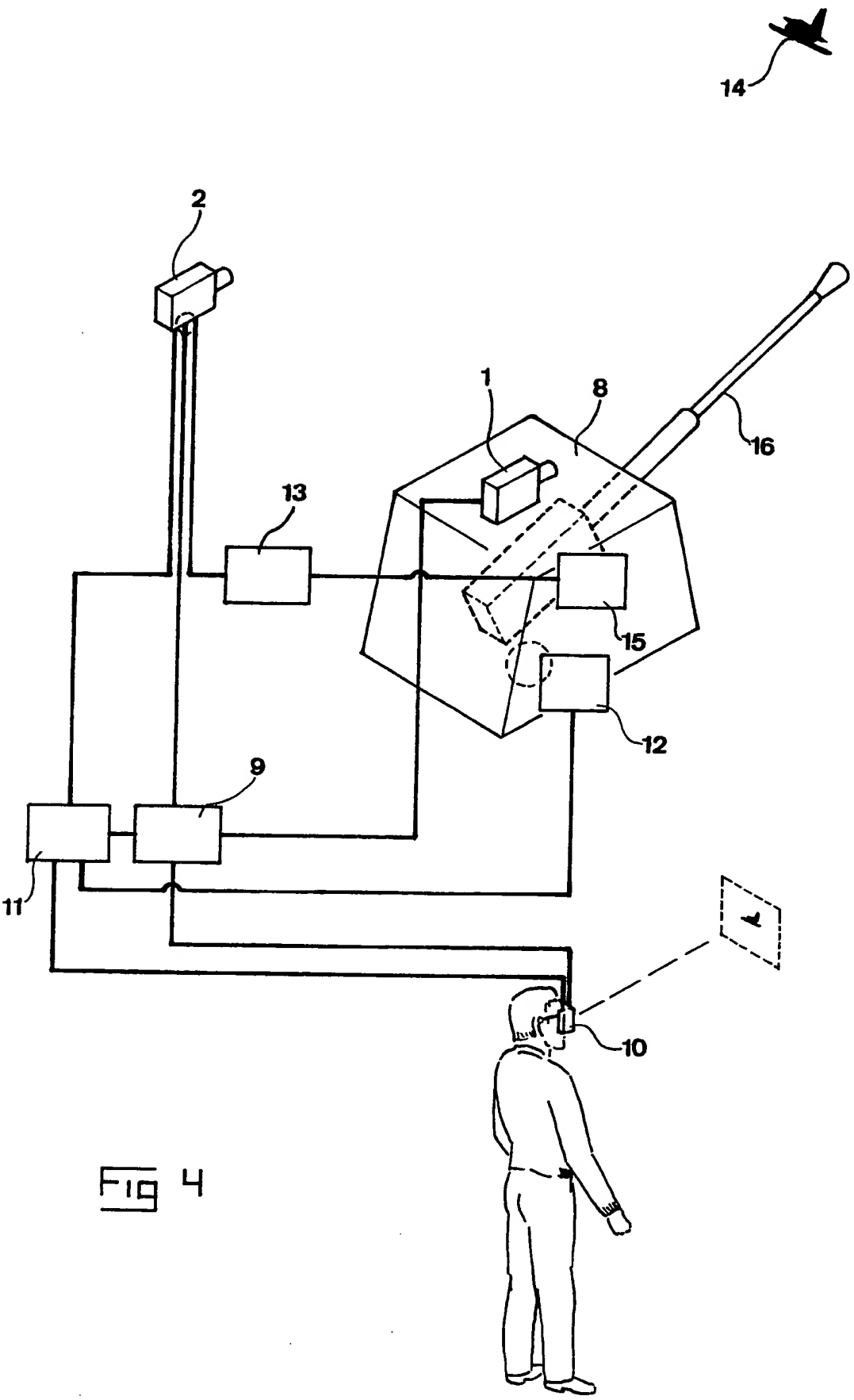
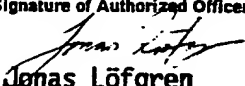
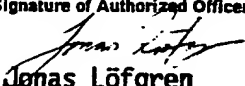
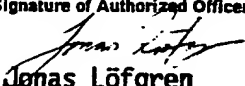


Fig 4

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00105

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: F 41 G 3/02																				
II. FIELDS SEARCHED <div style="text-align: center; border: 1px solid black; padding: 2px;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border: 1px solid black;">Classification System</th> <th style="border: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; height: 40px; vertical-align: bottom;">IPC5</td> <td style="border: 1px solid black; vertical-align: bottom;">F 41 G; G 01 C; G 06 F</td> </tr> </table> <div style="text-align: center; border: 1px solid black; padding: 2px;">Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in Fields Searched⁸</div> <p style="padding: 5px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	F 41 G; G 01 C; G 06 F														
Classification System	Classification Symbols																			
IPC5	F 41 G; G 01 C; G 06 F																			
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; border: 1px solid black;">Category *</th> <th style="border: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 10%; border: 1px solid black;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">US, A, 4209255 (HEYNAU ET AL) 24 June 1980, see abstract; figure 1 --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">US, A, 4644845 (GAREHIME, JR.) 24 February 1987, see abstract; figures 1,4 --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">SE, B, 353393 (HONEYWELL INC.) 29 January 1973, see the whole document --</td> <td style="border: 1px solid black; text-align: center;">1,5</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">US, A, 4109145 (GRAF) 22 August 1978, see claims 1,2 --</td> <td style="border: 1px solid black; text-align: center;">1,7</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">US, A, 4570530 (ARMSTRONG) 18 February 1986, see abstract; figure 1 --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	US, A, 4209255 (HEYNAU ET AL) 24 June 1980, see abstract; figure 1 --	1	A	US, A, 4644845 (GAREHIME, JR.) 24 February 1987, see abstract; figures 1,4 --	1	A	SE, B, 353393 (HONEYWELL INC.) 29 January 1973, see the whole document --	1,5	A	US, A, 4109145 (GRAF) 22 August 1978, see claims 1,2 --	1,7	A	US, A, 4570530 (ARMSTRONG) 18 February 1986, see abstract; figure 1 --	1
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³																		
A	US, A, 4209255 (HEYNAU ET AL) 24 June 1980, see abstract; figure 1 --	1																		
A	US, A, 4644845 (GAREHIME, JR.) 24 February 1987, see abstract; figures 1,4 --	1																		
A	SE, B, 353393 (HONEYWELL INC.) 29 January 1973, see the whole document --	1,5																		
A	US, A, 4109145 (GRAF) 22 August 1978, see claims 1,2 --	1,7																		
A	US, A, 4570530 (ARMSTRONG) 18 February 1986, see abstract; figure 1 --	1																		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																				
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 1st November 1991 </td> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 1991 -11- 0 5 </td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;"> International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div> </td> <td style="border: 1px solid black; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;">  Jonas Löfgren </div> </td> </tr> </table>			Date of the Actual Completion of the International Search 1st November 1991	Date of Mailing of this International Search Report 1991 -11- 0 5	International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">  Jonas Löfgren </div>														
Date of the Actual Completion of the International Search 1st November 1991	Date of Mailing of this International Search Report 1991 -11- 0 5																			
International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">  Jonas Löfgren </div>																			

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	SE, B, 458395 (FERRANTI INTERNATIONAL SIGNAL PLC CHEADLE GB) 20 March 1989, see page 3, line 9 - page 4, line 14; figure 1 -- -----	1

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00105**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on **91-09-27**
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4209255	80-06-24	NONE	
US-A- 4644845	87-02-24	US-A- 4112818 US-A- 4617750	78-09-12 86-10-21
SE-B- 353393	73-01-29	CH-A- 480651 DE-A- 1797136 FR-A- 1579752 GB-A- 1175945 NL-A- 6811914 US-A- 3462604	69-10-31 71-07-22 69-08-29 70-01-01 69-02-25 69-08-19
US-A- 4109145	78-08-22	NONE	
US-A- 4570530	86-02-18	NONE	
SE-B- 458395	89-03-20	DE-A- 3426505 FR-A- 2549610 GB-A-B- 2143948 JP-A- 60042734 SE-A- 8403706 US-A- 4722601	85-01-31 85-01-25 85-02-20 85-03-07 85-01-24 88-02-02